

IN THE CLAIMS:

1.-60. (Canceled)

61. (Currently Amended) A method of manufacturing an active matrix display device having an active matrix circuit and a driving circuit, said method comprising:

- forming an ion blocking film over a substrate;
- forming a non-single crystalline semiconductor layer ~~comprising amorphous silicon~~ over said ion blocking film ~~to a thickness of 200—1500 Å;~~
- providing a first laser beam having a first cross section;
- expanding said first cross section of the first pulsed laser beam ~~[[in]]~~ along a first direction;
- condensing the expanded laser beam ~~[[in]]~~ along a second direction orthogonal to said first direction;
- irradiating the non-single crystalline semiconductor layer with the condensed laser beam having a second cross section at a surface of the non-single crystalline semiconductor layer wherein a length of said second cross section ~~[[in]]~~ along said first direction is longer than that of said first cross section and a width of said second cross section ~~[[in]]~~ along said second direction is smaller than that of said first cross section;
- moving a relative location of said substrate to the condensed laser beam along a third direction orthogonal to said first direction ~~so that the semiconductor layer is scanned with the condensed laser beam and~~ while irradiating the non-single crystalline semiconductor layer with the condensed laser beam whereby the non-single crystalline semiconductor layer is crystallized; ~~[[and]]~~
- removing an insulating layer comprising silicon oxide from an upper surface of the crystallized semiconductor layer; and
- forming a plurality of thin film transistors using the crystallized semiconductor layer as at least channel regions of the thin film transistors for the active matrix circuit and said driving circuit;
- ~~wherein both of the active matrix circuit and said driving circuit include said thin film transistors.~~

62. (Previously presented) The method according to claim 61 wherein said laser beam is an excimer laser beam.

63. (Previously presented) The method according to claim 61 wherein said ion blocking film comprises silicon oxide.

64. (Previously presented) The method according to claim 61 wherein said blocking film comprises silicon nitride.

65. (Previously presented) The method according to claim 61 wherein said ion blocking film comprises non-doped silicon oxide.

66. (Currently Amended) A method of manufacturing an active matrix display device having an active matrix circuit and a driving circuit, said method comprising:

forming an ion blocking film over a substrate ~~to a thickness of 1000—4000 Å;~~

forming a non-single crystalline semiconductor layer comprising amorphous silicon over said ion blocking film, said non-single crystalline semiconductor layer being substantially intrinsic and doped with a dopant selected from the group consisting of boron and arsenic to a thickness of 200—1500 Å;

providing a first laser beam having a first cross section;

expanding said first cross section of the first pulsed laser beam [[in]] along a first direction;

condensing the expanded laser beam [[in]] along a second direction orthogonal to said first direction;

irradiating the non-single crystalline semiconductor layer with the condensed laser beam having a second cross section at a surface of the non-single crystalline semiconductor layer wherein a length of said second cross section [[in]] along said first direction is longer than that of said first cross section and a width of said second cross section [[in]] along said second direction is smaller than that of said first cross section;

moving a relative location of said substrate to the condensed laser beam along a third direction orthogonal to said first direction while irradiating the non-single crystalline semiconductor layer with the condensed laser beam so that the semiconductor layer is

~~scanned with the condensed laser beam and~~ whereby the non-single crystalline semiconductor layer is crystallized; and

forming a plurality of thin film transistors using the crystallized semiconductor layer as at least channel regions of the thin film transistors for the active matrix circuit and said driving circuit;

~~wherein both of the active matrix circuit and said driving circuit include said thin film transistors.~~

67. (Previously presented) The method according to claim 66 wherein said laser beam is an excimer laser beam.

68. (Previously presented) The method according to claim 66 wherein said ion blocking film comprises silicon oxide.

69. (Previously presented) The method according to claim 66 wherein said blocking film comprises silicon nitride.

70. (Previously presented) The method according to claim 66 wherein said ion blocking film comprises non-doped silicon oxide.

71. (Currently Amended) A method of manufacturing an active matrix display device having an active matrix circuit and a driving peripheral circuit for driving pixel TFTs, said method comprising:

forming an ion blocking film over a substrate;

forming a non-single crystalline semiconductor layer ~~comprising amorphous silicon~~ over said ion blocking film ~~to a thickness of 200—1500 Å;~~

providing a first laser beam having a first cross section ~~wherein said laser beam is a pulsed laser beam having a wavelength of not longer than 400 nm;~~

expanding said first cross section of the first pulsed laser beam ~~[[in]]~~ along a first direction;

condensing the expanded laser beam ~~[[in]]~~ along a second direction orthogonal to said first direction;

irradiating the non-single crystalline semiconductor layer with the condensed laser beam having a second cross section at a surface of the non-single crystalline semiconductor layer wherein a length of said second cross section ~~[[in]]~~ along said first direction is longer than that of said first cross section and a width of said second cross section ~~[[in]]~~ along said second direction is smaller than that of said first cross section;

moving a relative location of said substrate to the condensed laser beam along a third direction orthogonal to said first direction ~~so that the semiconductor layer is scanned with the condensed laser beam and~~ while irradiating the non-single crystalline semiconductor layer with the condensed laser beam whereby the non-single crystalline semiconductor layer is crystallized; ~~[[and]]~~

removing an insulating layer comprising silicon oxide from an upper surface of the crystallized semiconductor layer; and

forming a plurality of thin film transistors using the crystallized semiconductor layer as at least channel regions of the thin film transistors for the active matrix circuit and said peripheral circuit;

~~wherein both of the active matrix circuit and said driving circuit include said thin film transistors.~~

72. (Previously presented) The method according to claim 71 wherein said laser beam is an excimer laser beam.

73. (Previously presented) The method according to claim 71 therein said ion blocking film comprises silicon oxide.

74. (Previously presented) The method according to claim 71 wherein said blocking film comprises silicon nitride.

75. (Previously presented) The method according to claim 71 wherein said ion blocking film comprises non-doped silicon oxide.

76. (Currently Amended) A method of manufacturing an active matrix display device having an active matrix circuit and a driving peripheral circuit for driving pixel TFTs, said method comprising:

forming an ion blocking film over a ~~[[glass]]~~ substrate ~~containing alkali ions~~;  
forming a non-single crystalline semiconductor layer ~~comprising amorphous silicon~~  
over said ion blocking film ~~to a thickness of 200–1500 Å~~; said non-single crystalline  
semiconductor layer being substantially intrinsic and doped with a dopant selected from the  
group consisting of boron and arsenic;  
providing a first laser beam having a first cross section;  
expanding said first cross section of the first pulsed laser beam ~~[[in]]~~ along a first  
direction;  
condensing the expanded laser beam ~~[[in]]~~ along a second direction orthogonal to said  
first direction;  
irradiating the non-single crystalline semiconductor layer with the condensed laser  
beam having a second cross section at a surface of the semiconductor layer wherein a length  
of said second cross section ~~[[in]]~~ along said first direction is longer than that of said first  
cross section and a width of said second cross section ~~[[in]]~~ along said second direction is  
smaller than that of said first cross section;  
moving a relative location of said substrate to the condensed laser beam along a third  
direction orthogonal to said first direction so that the semiconductor layer is scanned with the  
condensed laser beam and whereby the semiconductor layer is crystallized; and  
forming a plurality of thin film transistors using the crystallized semiconductor layer  
as at least channel regions of the thin film transistors for said active matrix circuit and said  
peripheral circuit;  
~~wherein both of the active matrix circuit and said driving circuit include said thin film~~  
~~transistors.~~

77. (Previously presented) The method according to claim 76 wherein said laser beam is an excimer laser beam.

78. (Previously presented) The method according to claim 76 wherein said ion blocking film comprises silicon oxide.

79. (Previously presented) The method according to claim 76 wherein said blocking film comprises silicon nitride.

80. (Previously presented) The method according to claim 76 wherein said ion blocking film comprises non-doped silicon oxide.

81. -90. (Canceled)

91. (Currently amended) The method according to claim 61 further comprising a step of removing a peripheral portion of the expanded laser beam through a mask before the step of condensing the expanded laser beam wherein said peripheral portion includes at least edges of the expanded laser beam extending along said first direction.

92. (Currently amended) The method according to claim 66 further comprising a step of removing a peripheral portion of the expanded laser beam through a mask before the step of condensing the expanded laser beam wherein said peripheral portion includes at least edges of the expanded laser beam extending along said first direction.

93. (Currently amended) The method according to claim 71 further comprising a step of removing a peripheral portion of the expanded laser beam through a mask before the step of condensing the expanded laser beam wherein said peripheral portion includes at least edges of the expanded laser beam extending along said first direction.

94. (Currently amended) The method according to claim 76 further comprising a step of removing a peripheral portion of the expanded laser beam through a mask before the step of condensing the expanded laser beam wherein said peripheral portion includes at least edges of the expanded laser beam extending along said first direction.

95. -100. (Canceled)

101. (Currently amended) The method according to claim 76 wherein said glass substrate is a soda-lime glass.

102. -103. (Canceled)

104. (Previously presented) The method according to claim 61 wherein said active matrix display device is a liquid crystal device.

105. (Previously presented) The method according to claim 66 wherein said active matrix display device is a liquid crystal device.

106. (Previously presented) The method according to claim 71 wherein said active matrix display device is a liquid crystal device.

107. (Previously presented) The method according to claim 76 wherein said active matrix display device is a liquid crystal device.

108 -130. (Cancelled)

131. (Previously presented) The method according to claim 61 wherein said laser beam is a pulsed laser beam and said substrate is moved in a stepwise manner.

132. -139. (Cancelled)

140. (New) A method of manufacturing an active matrix display device having an active matrix circuit and a driving circuit, said method comprising:

forming an ion blocking film over a substrate;

forming a plurality of semiconductor islands for said active matrix circuit and said driving circuit over the ion blocking film, each of said semiconductor islands comprising crystallized silicon;

forming a gate insulating film on said plurality of semiconductor islands wherein said gate insulating film covers a surface of the ion blocking film, said surface being exposed between the plurality of semiconductor islands;

forming gate electrodes over the semiconductor islands with the gate insulating film interposed therebetween,

wherein the formation of said plurality of semiconductor islands comprises steps of:

providing a first laser beam having a first cross section;

expanding said first cross section of the first pulsed laser beam along a first direction;

condensing the expanded laser beam along a second direction orthogonal to said first direction; and

directing the condensed laser beam to the substrate while moving a relative location of the substrate to the condensed laser beam along a third direction orthogonal to said first direction,

wherein the condensed laser beam has a second cross section on the substrate wherein a length of said second cross section along said first direction is longer than that of said first cross section and a width of said second cross section along said second direction is smaller than that of said first cross section.

141. (New) A method of manufacturing an active matrix display device having an active matrix circuit and a driving circuit, said method comprising:

forming an ion blocking film over a substrate;

forming a plurality of semiconductor islands for said active matrix circuit and said driving circuit over the ion blocking film, each of said semiconductor islands comprising crystallized silicon;

forming a gate insulating film on said plurality of semiconductor islands;

forming metal gate electrodes over the semiconductor islands with the gate insulating film interposed therebetween;

introducing an impurity into portions of the semiconductor islands to form source and drain regions in each of the semiconductor islands with said gate electrodes used as a mask,

wherein the formation of said plurality of semiconductor islands comprises steps of:

providing a first laser beam having a first cross section;

expanding said first cross section of the first pulsed laser beam along a first direction;

condensing the expanded laser beam along a second direction orthogonal to said first direction; and

directing the condensed laser beam to the substrate while moving a relative location of the substrate to the condensed laser beam along a third direction orthogonal to said first direction,

wherein the condensed laser beam has a second cross section on the substrate wherein a length of said second cross section along said first direction is longer than that of said first cross section and a width of said second cross section along said second direction is smaller than that of said first cross section.



142. (New) The method according to claim 61 or 66 wherein said non-single crystalline semiconductor layer comprises amorphous silicon.

143. (New) The method according to claim 61 or 66 wherein said non-single crystalline semiconductor layer comprises solid phase crystallized silicon.

144. (New) The method according to claim 66 further comprising a step of removing an insulating layer comprising silicon oxide from an upper surface of the crystallized semiconductor layer.

145. (New) The method according to any one of claim 140 to 141 wherein said ion blocking film comprises silicon oxide.

146. (New) The method according to any one of claim 140 to 141 wherein said ion blocking film comprises silicon nitride.

147. (New) The method according to any one of claim 140 to 141 wherein said ion blocking film comprises non-doped silicon oxide.

148. (New) The method according to any one of claim 140 and 141 further comprising a step of removing a peripheral portion of the expanded laser beam through a mask before the step of condensing the expanded laser beam wherein said peripheral portion includes at least edges of the expanded laser beam extending along said first direction.

149. (New) The method according to any one of claim 61, 66, 140 and 141 wherein said substrate is moved.

150. (New) The method according to any one of claim 61, 66, 140 and 141 wherein said ion blocking film blocks sodium from the substrate.

151. (New) A method of manufacturing a plurality of thin film transistors, comprising steps of:

- forming an ion blocking film over a substrate;
- forming a non-single crystalline semiconductor layer over said ion blocking film;
- providing a first laser beam having a first cross section;
- expanding said first cross section of the first pulsed laser beam along a first direction;
- condensing the expanded laser beam along a second direction orthogonal to said first direction;
- irradiating the non-single crystalline semiconductor layer with the condensed laser beam having a second cross section at a surface of the non-single crystalline semiconductor layer wherein a length of said second cross section along said first direction is longer than that of said first cross section and a width of said second cross section along said second direction is smaller than that of said first cross section;
- moving a relative location of said substrate to the condensed laser beam along a third direction orthogonal to said first direction while irradiating the non-single crystalline semiconductor layer with the condensed laser beam whereby the non-single crystalline semiconductor layer is crystallized;
- removing an insulating layer comprising silicon oxide from an upper surface of the crystallized semiconductor layer; and
- forming a plurality of thin film transistors using the crystallized semiconductor layer as at least channel regions of the thin film transistors.

152. (New) A method of manufacturing a plurality of thin film transistors, comprising steps of:

- forming an ion blocking film over a substrate;
- forming a non-single crystalline semiconductor layer over said ion blocking film, said non-single crystalline semiconductor layer being substantially intrinsic and doped with a dopant selected from the group consisting of boron and arsenic;
- providing a first laser beam having a first cross section;
- expanding said first cross section of the first pulsed laser beam along a first direction;
- condensing the expanded laser beam along a second direction orthogonal to said first direction;

irradiating the non-single crystalline semiconductor layer with the condensed laser beam having a second cross section at a surface of the non-single crystalline semiconductor layer wherein a length of said second cross section along said first direction is longer than that of said first cross section and a width of said second cross section along said second direction is smaller than that of said first cross section;

moving a relative location of said substrate to the condensed laser beam along a third direction orthogonal to said first direction while irradiating the non-single crystalline semiconductor layer with the condensed laser beam whereby the non-single crystalline semiconductor layer is crystallized; and

forming a plurality of thin film transistors using the crystallized semiconductor layer as at least channel regions of the thin film transistors.

153. (New) A method of manufacturing a plurality of thin film transistors comprising:

forming an ion blocking film over a substrate;

forming a plurality of semiconductor islands over the ion blocking film, each of said semiconductor islands comprising crystallized silicon;

forming a gate insulating film on said plurality of semiconductor islands wherein said gate insulating film covers a surface of the ion blocking film, said surface being exposed between the plurality of semiconductor islands;

forming gate electrodes over the semiconductor islands with the gate insulating film interposed therebetween,

wherein the formation of said plurality of semiconductor islands comprises steps of:

providing a first laser beam having a first cross section;

expanding said first cross section of the first pulsed laser beam along a first direction;

condensing the expanded laser beam along a second direction orthogonal to said first direction; and

directing the condensed laser beam to the substrate while moving the substrate along a third direction orthogonal to said first direction,

wherein the condensed laser beam has a second cross section on the substrate wherein a length of said second cross section along said first direction is longer than that of said first cross section and a width of said second cross section along said second direction is smaller than that of said first cross section.

154. (New) A method of manufacturing a plurality of thin film transistors comprising:

- forming an ion blocking film over a substrate;
- forming a plurality of semiconductor islands over the ion blocking film, each of said semiconductor islands comprising crystallized silicon;
- forming a gate insulating film on said plurality of semiconductor islands;
- forming metal gate electrodes over the semiconductor islands with the gate insulating film interposed therebetween;
- introducing an impurity into portions of the semiconductor islands to form source and drain regions in each of the semiconductor islands with said gate electrodes used as a mask, wherein the formation of said plurality of semiconductor islands comprises steps of:
  - providing a first laser beam having a first cross section;
  - expanding said first cross section of the first pulsed laser beam along a first direction;
  - condensing the expanded laser beam along a second direction orthogonal to said first direction; and
  - directing the condensed laser beam to the substrate while moving the substrate along a third direction orthogonal to said first direction,
- wherein the condensed laser beam has a second cross section on the substrate wherein a length of said second cross section along said first direction is longer than that of said first cross section and a width of said second cross section along said second direction is smaller than that of said first cross section.

155. (New) The method according to claim 151 or 152 wherein said non-single crystalline semiconductor layer comprises amorphous silicon.

156. (New) The method according to claim 151 or 152 wherein said non-single crystalline semiconductor layer comprises solid phase crystallized silicon.

157. (New) The method according to claim 152 further comprising a step of removing an insulating layer comprising silicon oxide from an upper surface of the crystallized semiconductor layer.

158. (New) The method according to any one of claim 151 to 154 wherein said ion blocking film comprises silicon oxide.

159. (New) The method according to any one of claim 151 to 154 wherein said ion blocking film comprises silicon nitride.

160. (New) The method according to any one of claim 151 to 154 wherein said ion blocking film comprises non-doped silicon oxide.

161. (New) The method according to any one of claim 151 to 154 further comprising a step of removing a peripheral portion of the expanded laser beam through a mask before the step of condensing the expanded laser beam wherein said peripheral portion includes at least edges of the expanded laser beam extending along said first direction.

162. (New) The method according to any one of claim 151 to 154 wherein said substrate is moved.

163. (New) The method according to any one of claim 151 to 154 wherein said ion blocking film blocks sodium from the substrate.

164. (New) A method of manufacturing an active matrix display device having an active matrix circuit and a peripheral circuit for driving pixel TFTs, said method comprising:

forming an ion blocking film over a substrate;

forming a plurality of semiconductor islands for said active matrix circuit and said peripheral circuit over the ion blocking film, each of said semiconductor islands comprising crystallized silicon;

forming a gate insulating film on said plurality of semiconductor islands wherein said gate insulating film covers a surface of the ion blocking film, said surface being exposed between the plurality of semiconductor islands;

forming gate electrodes over the semiconductor islands with the gate insulating film interposed therebetween,

wherein the formation of said plurality of semiconductor islands comprises steps of:

providing a first laser beam having a first cross section;

expanding said first cross section of the first pulsed laser beam along a first direction;  
condensing the expanded laser beam along a second direction orthogonal to said first direction; and

directing the condensed laser beam to the substrate while moving the substrate along a third direction orthogonal to said first direction,

wherein the condensed laser beam has a second cross section on the substrate wherein a length of said second cross section along said first direction is longer than that of said first cross section and a width of said second cross section along said second direction is smaller than that of said first cross section.

165. (New) A method of manufacturing an active matrix display device having an active matrix circuit and a peripheral circuit, said method comprising:

forming an ion blocking film over a substrate;

forming a plurality of semiconductor islands for said active matrix circuit and said peripheral circuit over the ion blocking film, each of said semiconductor islands comprising crystallized silicon;

forming a gate insulating film on said plurality of semiconductor islands;

forming metal gate electrodes over the semiconductor islands with the gate insulating film interposed therebetween;

introducing an impurity into portions of the semiconductor islands to form source and drain regions in each of the semiconductor islands with said gate electrodes used as a mask,

wherein the formation of said plurality of semiconductor islands comprises steps of:

providing a first laser beam having a first cross section;

expanding said first cross section of the first pulsed laser beam along a first direction;

condensing the expanded laser beam along a second direction orthogonal to said first direction; and

directing the condensed laser beam to the substrate while moving a relative location of the substrate to the condensed laser beam along a third direction orthogonal to said first direction,

wherein the condensed laser beam has a second cross section on the substrate wherein a length of said second cross section along said first direction is longer than that of said first cross section and a width of said second cross section along said second direction is smaller than that of said first cross section.

166. (New) The method according to claim 71 or 76 wherein said non-single crystalline semiconductor layer comprises amorphous silicon.

167. (New) The method according to claim 71 or 76 wherein said non-single crystalline semiconductor layer comprises solid phase crystallized silicon.

168. (New) The method according to claim 76 further comprising a step of removing an insulating layer comprising silicon oxide from an upper surface of the crystallized semiconductor layer.

169. (New) The method according to any one of claims 164-165 wherein said ion blocking film comprises silicon oxide.

170. (New) The method according to any one of claims 164-165 wherein said ion blocking film comprises silicon nitride.

171. (New) The method according to any one of claims 164-165 wherein said ion blocking film comprises non-doped silicon oxide.

172. (New) The method according to any one of claims 164-165 further comprising a step of removing a peripheral portion of the expanded laser beam through a mask before the step of condensing the expanded laser beam wherein said peripheral portion includes at least edges of the expanded laser beam extending along said first direction.

173. (New) The method according to any one of claims 71, 76 and 164-165 wherein said substrate is moved.

174. (New) The method according to any one of claims 71, 76 and 164-165 wherein said ion blocking film blocks sodium from the substrate.

175. (New) The method according to anyone of claims 61, 66, 71, 76, 140, 141, 151, 152, 164 and 165 wherein said substrate is a glass substrate.